AMENDMENTS TO THE SPECIFICATION

Please substitute the paragraph beginning at page 1, line 8 and ending at page 1, line 15 to read as follows:

The present invention ~~is~~ relates to an image processing method, an image processing device to carry out the image processing method, and a recording medium to record a program implementing the image processing method, whereby the quality of an image produced on photosensitive material from digital image data is improved by reducing particle noise that cause a coarse look of the image without blurring the edges in the image.

Please substitute the paragraph beginning at page 2, line 1 and ending at page 2, line 12 to read as follows:

Conventionally, photographs have been printed by analog exposure whereby light is projected onto a photographic film recording having an original image thereon, so that the light having passed through that photographic film illuminates photographic printing paper. Another popular method in recent years is digital exposure whereby monochromatic red, green, and

blue lights are projected on each pixel on photographic printing paper for printing on the basis of digital image data obtained by scanning an image on a photographic film with a scanner or the like or by taking photographs with a digital camera, etc.

Please substitute the paragraph beginning at page 2, line 13 and ending at page 2, line 25 to read as follows:

In a photographic printing device for carrying out digital exposure, the pixel density of an image printed on photographic printing paper is dictated by the resolution of the scanner and that of the exposure head. Particles forming an image on a positive film have a typical density of about 2500 dpi. Digital-exposure photographic printing devices are already introduced to the market with the same level of resolution as the particle density. The digital-exposure photographic printing device is capable of acquiring an image having the same level of resolution as the particle density of a film and printing on photographic printing paper images that are ~~no~~ not inferior to those printed by analog exposure.

Please substitute the paragraph beginning at page 3, line 4

and ending at page 3, line 12 to read as follows:

The photographic printing device for carrying out digital exposure can process image data and produces on the image such various special effects that an analog-exposure photographic printing device cannot produce. One of the special effects is sharpening whereby images (for example, those of people in the background and of facial features of a person) have prominent edges. In the following description, more details will be given as to sharpening.

Please substitute the paragraph beginning at page 6, line 19 and ending at page 6, line 24 to read as follows:

To sum up the description so far, the spatial filter, when used in processing image data, hardly changes the image data in monotonous parts of the image, but increases luminosity differences at the edges. Subjecting all the pixels of the image to this process enhances the sharpness of the whole image.

Please substitute the paragraph beginning at page 7, line 3 and ending at page 7, line 15 to read as follows:

The aforementioned high resolution digital-exposure photographic printing device is capable of acquiring an image having practically the same level of resolution as the particle density of a film. A photograph, if printed on the same scale as the photographic film, is made of pixels, each as large as a film particle. The film particles share among them very similar, but not completely identical, coloring properties and cause fine variations in chromaticity and luminosity. The "noise" occurring in the film particle level (hereinafter, will be referred to as film particle noises) is passed on in the course of printing, causing a coarse look of the printed photograph.

Please substitute the paragraph beginning at page 7, line 22 and ending at page 8, line 3 to read as follows:

In short, the conventional sharpening method exacerbates the particulate nature of the photographic film, as well as enhances edges in an image, imparting a more coarse look to the image printed on photographic printing paper. The resultant image may look very ugly. Image quality degrades, especially, if human skin gives a rough look.

Please insert the following paragraph on page 15, between line 11 and line 13:

Figure 12 is a flowchart showing an image processing method in accordance with the present invention.

Please substitute the title and the paragraph beginning at page 15, line 13 and ending at page 15, line 15 to read as follows:

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following will describe an embodiment of the present invention in reference to Figure 1 to Figure ~~10~~ 12.

Please substitute the paragraph beginning at page 16, line 6 and ending at page 16, line 21 to read as follows:

That said, applying powerful blurring to chromaticity data and soft blurring to luminosity data uniformly across the entire image does not ~~much~~ enhance the sharpness of the image very much, since such blurring takes no edge information into account. This problem is addressed by extracting areas that are considered as

forming edges in the image and then applying either restrained blurring or no blurring at all in those areas, while applying strong blurring to chromaticity data and soft blurring to luminosity data in the other areas; this processing retains edge information more effectively without sacrificing effectiveness in noise removal. Understanding the relationships between the blurring techniques and the retainability of edge information provided the basis for the second insight that led us successfully to the present invention.

Please substitute the paragraph beginning at page 20, line 11 and ending at page 20, line 25 to read as follows:

The exposure section 5 controls exposure (inclusive of no exposure) of photographic printing paper for each pixel according to the BGR sets of image data supplied from the image processing section 4 to print an image on the photographic printing paper. Examples of means to control light exposure include PLZT exposure heads, DMDs (digital micromirror devices), LCDs (liquid crystal displays), LEDs (light emitting diode) panels, lasers, FOCRTs (fiber optic cathode ray tubes), and CRTs (cathodes ray tube). Needless to say, there must be provided a separate light source

to the PLZT exposure head, DMD, LCD and other control means that does not emit light by itself. A rotary BGR filter, as well as a printing and other light-focus lenses, are also disposed for each color where necessary.

Please substitute the paragraph beginning at page 21, line 20 and ending at page 22, line 2 to read as follows:

The Y/C separator section 6 is a block converting the BGR sets of image data supplied from the imaging section 1 to YCC data. The Y/C separator section 6 converts the BGR sets of image data to a combination of luminosity data YY_{xy} and chromaticity data BY_{xy}, RY_{xy}. Characters x, y in subscript position in YY_{xy}, BY_{xy}, [[,]] and RY_{xy} are a two-dimensional coordinate notation for pixels in a CCD in the imaging section 1.

Please substitute the paragraph beginning at page 24, line 10 and ending at page 24, line 15 to read as follows:

Noise in general is abnormality in luminosity and chromaticity that either recurs (for example, stripes) or occurs in a pixel ~~out~~ all of a sudden. The noise that we would like to

reduce in the present invention is film particle noise caused by non-uniform distribution of coloring properties of the film particles.

Please substitute the paragraph beginning at page 28, line 20 and ending at page 29, line 8 to read as follows:

To retain edges in the image, edges are first identified on the basis of variations of the luminosity data YY_{xy}. Blurring should not applied at all to the edges and should be increasingly strong ~~as~~ upon moving away from the edges, i.e., moving close to the monotonous parts of the image where luminosity and chromaticity vary by only small amounts. In addition, in those areas where blurring is implemented, the chromaticity noise should be relatively thoroughly removed, while the luminosity noise should be relatively partially removed. The noise-removing-rate computing section 7 computes such a chromaticity-noise-removing-ratio parameter RC and a luminosity-noise-removing-ratio parameter RD that can establish an algorithm implementing the blurring.

Please substitute the paragraph beginning at page 31, line 5

and ending at page 31, line 13 to read as follows:

To achieve another objective of the present invention that in those areas where blurring is implemented, the chromaticity noise should be relatively thoroughly removed, while the luminosity noise should be relatively partially ~~removed, the~~ removed. The rates at which the chromaticity data BY_{xy}, RY_{xy} is replaced with associated mean values should be specified greater than the rate at which the luminosity data YY_{xy} is replaced with an associated mean value.

Please substitute the paragraph beginning at page 34, line 16 and ending at page 34, line 20 to read as follows:

Now, the operation of the blurring section 2 based on equations 1-5 will be described in detail. Let us take the luminosity data example involving 3 × 3 pixels introduced in the *Background of the Invention* section above for convenience.

Please substitute the paragraph beginning at page 36, line 15 and ending at page 37, line 1 to read as follows:

Finally, the luminosity noise removing section 15 computes replacement luminosity data YY_{xy}' for the target pixel from the luminosity data YY_{xy} fed from the Y/C separator section 6, the mean luminosity data YY_{av} fed from the mean value computing section 13, and the luminosity-noise-removing-ratio parameter RD fed from the luminosity-noise-removing-rate computing section 11 according to equation 5 for each unit area, so as to replace the luminosity data YY_{xy} of the target pixel with the replacement luminosity data YY_{xy}'. All the pixels are subjected to this process until all the luminosity data YY_{xy} is replaced with replacement luminosity data YY_{xy}' (Step 9 in Figure 12).

Please substitute the paragraph beginning at page 37, line 2 and ending at page 37, line 11 to read as follows:

The target pixel in the foregoing monotonous part of the image has luminosity data $YY_{xy} = 50$ and computed replacement luminosity data $YY_{xy}' = 50$, which happen to be identical. The original luminosity data does not change in the process, and the resulting luminosity data is

51 49 53

52 50 49

48 51 47

Monotonous parts inherently do not ~~much~~ require much effective blurring.

Please substitute the paragraph beginning at page 37, line 12 and ending at page 37, line 19 to read as follows:

Further, at the edges ~~in~~ of an image, since the luminosity-noise-removing-ratio parameter RD equals 1, the replacement ratio for the mean luminosity data YY_{av} is 0, completely retaining the original luminosity data YY_{xy}. Consequently, in the blurring process of the present invention, the non-edge parts of the image are blurred, i.e., the noise is removed, but the edges are not affected and the image retains its contrast.

Please substitute the paragraph beginning at page 40, line 7 and ending at page 40, line 14 to read as follows:

The foregoing noise removal, capable of retaining edges in the image, is implemented by a program stored on a recording medium that is readable by a computer. In the present invention, the recording medium (not shown) may be a memory, for example, ~~an~~

a ROM, required for the image processing section 4 in Figure 2 to execute the process or a program medium that is readable when inserted in an external reader device.

Please substitute the paragraph beginning at page 41, line 4 and ending at page 41, line 11 to read as follows:

The system of the present invention is configured to connect to the Internet and other communications networks; the program medium may therefore ~~by~~ be a volatile transmission medium to which the program is downloaded over a communications network when necessary. In this case, the program to be downloaded may be preinstalled in the main device or installed from a different recording medium when necessary.

Please substitute the paragraph beginning at page 41, line 14 and ending at page 41, line 22 to read as follows:

As described so far, an image processing method in accordance with the present invention includes the steps of:

separating image data into luminosity data and chromaticity data (Step 1 in Figure 12); and

changing a rate of smoothing of the chromaticity data and a rate of smoothing of the luminosity data according to a variation of the luminosity data in two-dimensional coordinate space.

Please substitute the paragraph beginning at page 41, line 23 and ending at page 42, line 7 to read as follows:

Another image processing method in accordance with the present invention includes the features of this method and may be such that:

a first reference value (T_1) is specified as to a degree of the variation of the luminosity data (distribution parameter DP) (Step 2 in Figure 12); and

in image areas where the variation of the luminosity data (DP) is smaller than the first reference value (T_1) ($T_1 > DP$, Step 3 in Figure 12), the chromaticity data is subjected to the smoothing first (Step 4 in Figure 12) and, if necessary, the luminosity data is subjected to the smoothing thereafter (Step 6 in Figure 12).

Please substitute the paragraph beginning at page 43, line 4

and ending at page 43, line 12 to read as follows:

A further image processing method in accordance with the present invention includes the features of the foregoing method and may be such that:

a first reference value (T_1) is specified as to a degree of the variation of the luminosity data (DP) (Step 2 in Figure 12); and

in image areas where the variation of the luminosity data (DP) is smaller than the first reference value (T_1) ($T_1 > DP$, Step 3 in Figure 12), the rate of the smoothing of the chromaticity data is made greater than the rate of the smoothing of the luminosity data (Step 6 in Figure 12).

Please substitute the paragraph beginning at page 43, line 22 and ending at page 44, line 6 to read as follows:

A still further image processing method in accordance with the present invention includes the features of the foregoing method and may be such that:

a second reference value (T_2) is specified as to a degree of

the variation of the luminosity data (DP) (Step 2 in Figure 12) so that the second reference value (T_2) is smaller than the first reference value (T_1); and

in image areas where the variation of the luminosity data (DP) is larger than the second reference value (T_2) (DP > T_2, Step 5 in Figure 12), the luminosity data is not subjected to the smoothing (Step 7 in Figure 12).

Please substitute the paragraph beginning at page 44, line 21 and ending at page 44, line 25 to read as follows:

Meanwhile, removing noise from the chromaticity in at least those areas where the variation of the luminosity data is smaller than the first reference value as described in the foregoing produces ~~as~~ good results in the reduction of a coarse look of the image.

Please substitute the paragraph beginning at page 45, line 1 and ending at page 45, line 7 to read as follows:

A further image processing method in accordance with the

present invention includes the features of the foregoing method and may be such that

in image areas where the variation of the luminosity data (DP) is larger than the first reference value (T_1) (DP > T_1, Step 3 in Figure 12), the luminosity data is not subjected to the smoothing and the chromaticity data is not subjected to the smoothing (Step 8 in Figure 12).